

# Non-Standard Design Treatments

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Standard bicycle facility treatments do not always fit within the context of the existing built environment. Narrow rights-of-way, off angled intersections, and unique roadway geometry may necessitate the use of context sensitive, non-standard treatments. This document discusses several unique treatments that are gaining acceptance across the nation.

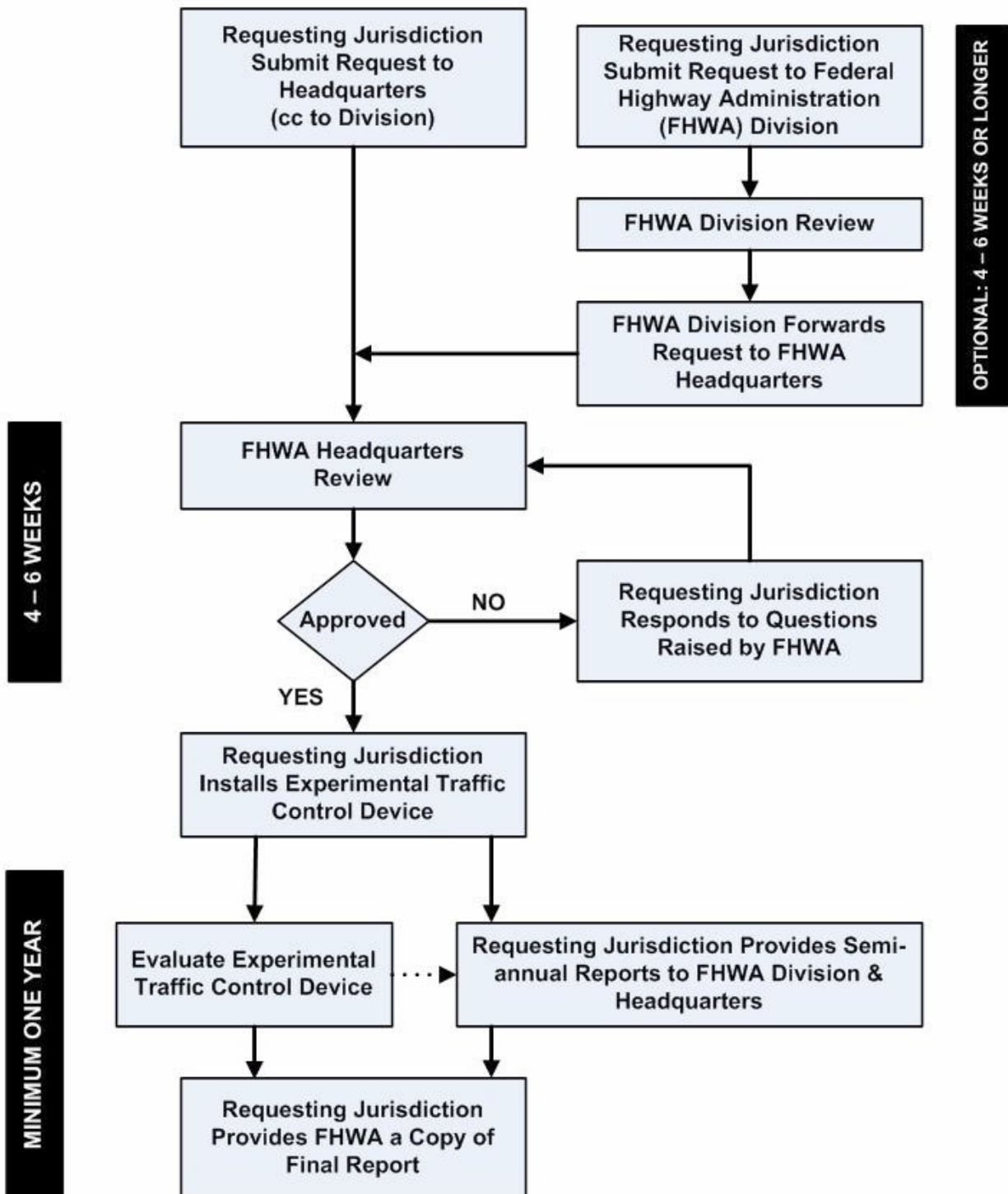
None of the treatments discussed in this document are contained within the standards set forth by the MUTCD. Any application of these treatments should follow the processes outlined on the following pages the Federal Highway Administration (FHWA). Installing non-standard treatments without going through the FHWA process could result in additional liability for the City of Milwaukee. It is not recommended to proceed on a non-standard project without conducting an official experiment through the FHWA.

The following is a summary of the FHWA experimentation procedure:

*“All requests for experimentation should originate with the State/ local highway agency or toll operator responsible for managing the roadway or controlled setting where experiment will take place. That organization forwards the request to the FHWA - with a courtesy copy to the FHWA Division Office. The FHWA must approve the experiment before it begins. Requests may also be forwarded directly to the FHWA Division Office, and the Division Office can submit the request to the FHWA Headquarters Office. All requests must include:*

- 1. A statement of the nature of the problem, including data that justifies the need for a new device or application.*
- 2. Describe the proposed change, how it was developed, how it deviates from the current MUTCD.*
- 3. Any illustration(s) that enhance understanding of the device or its use.*
- 4. Supporting data that explains how the experimental device was developed, if it has been tried, the adequacy of its performance, and the process by which the device was chosen or applied.*
- 5. A legally binding statement certifying that the concept of the traffic control device is not protected by a patent or copyright (see MUTCD Section 1A.10 for additional details.)*
- 6. The proposed time period and location(s) of the experiment.*
- 7. A detailed research or evaluation plan providing for close monitoring of the experimentation, especially in the early stages of field implementation. The evaluation plan should include before and after studies as well as quantitative data enabling a scientifically-sound evaluation of the performance of the device.*
- 8. An agreement to restore the experimental site to a condition that complies with the provisions of the MUTCD within 3 months following completion of the experiment. The agreement must also provide that the sponsoring agency will terminate the experiment at any time if it determines that the experiment directly or indirectly causes significant safety hazards. If the experiment demonstrates an improvement, the device or application may remain in place as a request is made to update the MUTCD and an official rulemaking action occurs.*
- 9. An agreement to provide semiannual progress reports for the duration of the experimentation and to provide a copy of the final results to the Office of Transportation Operations (HOTO) within three months of the conclusion of the experiment. HOTO may terminate approval of the experimentation if these reports are not provided on schedule.”*

## Obtaining Experimentation Approval for New Traffic Control Devices



## Wide Bicycle Lane Next to On-Street Parallel Parking

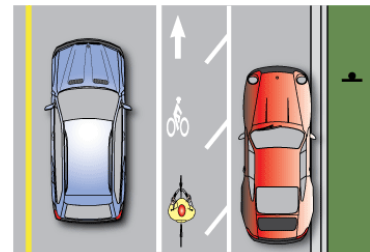
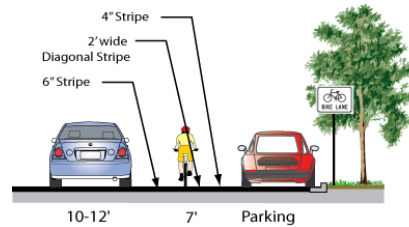
### Design Summary

#### Bicycle Lane Width:

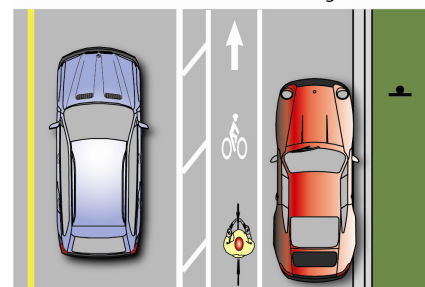
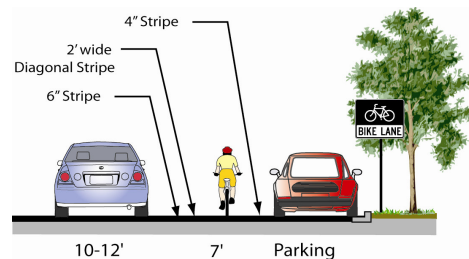
7' maximum (may encourage vehicle loading in bicycle lane)

### Discussion

- Wide bike lanes can be used in areas with significant amounts of bicycle traffic to increase capacity
- Wide bike lanes can increase the safety of the facility
- Wide bicycle lanes may encourage the bicyclist to ride farther to the right (door zone) to maximize distance from passing traffic
- Wide bicycle lanes may also encourage vehicles to use the bicycle lane as a loading zone in busy areas where on-street parking is typically full
- Installing smaller bicycle lane stencils placed to the left of are one way to increase separation
- Diagonal stripes can be added to encourage the bicyclist to ride to the left of the bicycle lane to reduce proximity to the door zone
- Alternative design 1 places striping between the bicycle and motor vehicle travel lane, visually narrows the vehicle travel lane and creates additional buffer space between slower moving bicycles and faster moving motor vehicles. This design may be problematic on streets with high parking turnover, particularly when cyclist volumes are also high. Motorists will block the bike lane during parking maneuvers and may use the wide bicycle lane as a temporary parking spot while waiting to pull into a legal curbside spot. Safety benefits gained from diagonal striping near parked vehicles (Minimum Design) may be lost. A modified option would add a small diagonal buffer alongside parked cars to encourage cyclists to travel further away from the door zone



### Minimum Design



### Alternative Design 1

### Guidance

This treatment is not currently present in any State or Federal design standards

## Bicycle Lane Next to On-Street Diagonal Parking

### Design Summary

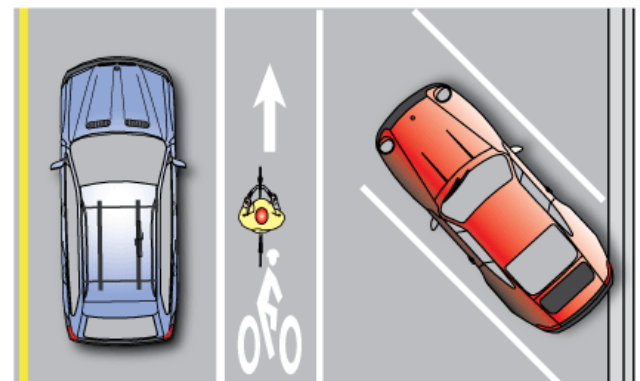
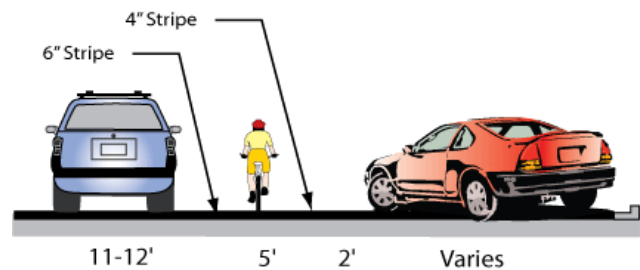
#### Bicycle Lane Width: 5' minimum

White 4-inch stripe separates bicycle lane from parking bays.

Parking bays are sufficiently long to accommodate most vehicles (vehicles do not block bicycle lane)

### Discussion

- In certain areas diagonal parking can be used to increase parking supply
- Conventional diagonal parking is not compatible or recommended in conjunction with high levels of bicycle traffic
- The use of 'back-in diagonal parking' or 'reverse angled parking' is recommended over head-in diagonal parking. This design addresses improves sight distance between drivers and bicyclists and has been shown to reduce parking related crashes
- While there may be a learning curve for some drivers, using back-in diagonal parking is typically an easier maneuver than conventional parallel parking



### Recommended Design

### Design Example



### Guidance

This treatment is not currently present in Federal design standards but recommended in some states including Oregon.

## Contra-Flow Bicycle Lane on One-Way Street

### Design Summary

#### Bicycle Lane Width:

5' minimum when adjacent to curb and gutter  
 5' recommended if next to on-street parallel parking (if applicable - non-contra-flow direction only)

### Discussion

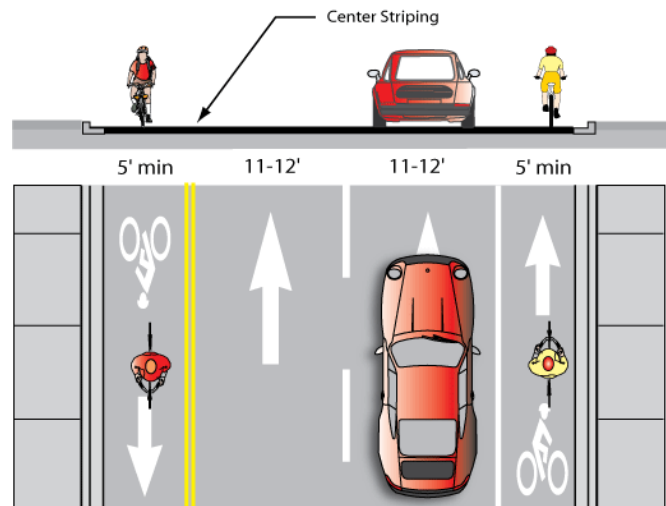
- Contra-flow bicycle lanes enable bicyclists to ride in the opposite direction of vehicle traffic on one-way streets
- Contra-flow bicycle lanes should only be considered when necessary to connect cycling facilities or destinations that would otherwise require significant out-of-direction travel
- The facility is placed on the opposite side of vehicle travel lanes (to the motorists' left), and separated from traffic with a double yellow line or extruded curb
- Contra-flow bicycle lanes work best when few intersecting streets, alleys, or driveways exist on the side of the contra-flow lane
- Contra-flow bicycle lanes exist in several U.S. cities, including Boise, Idaho; Boulder, Colorado; Minneapolis, Minnesota and Portland, Oregon

### Design Example



### Guidance

There is no currently adopted Federal or guidance for this treatment. State guidance can be found in the *Wisconsin Bicycle Facility Design Handbook*.



### Recommended Design

## Shared Lane Markings - “Sharrows”

## Design Summary

Shared Lane Markings are large pavement symbols that combine an arrow and a bicycle marking and help delineate specifically where cyclists should operate with the travel lane. Shared Lane Markings are a basic treatment for signed shared roadways and can be combined with other treatments (e.g., traffic calming) to create bicycle priority streets often referred to as “Bicycle Boulevards”.

## Discussion

- Used on streets where dedicated bicycle lanes are desirable but are not possible due to physical or other constraints.
- Are placed strategically in the travel lane to alert motorists of bicycle traffic in a linear pattern along a corridor (typically every 100-200 feet). Sharrows encourage cyclists to ride in a straight line so their movements are predictable to motorists.

The Shared Roadway Bicycle Marking is intended to:

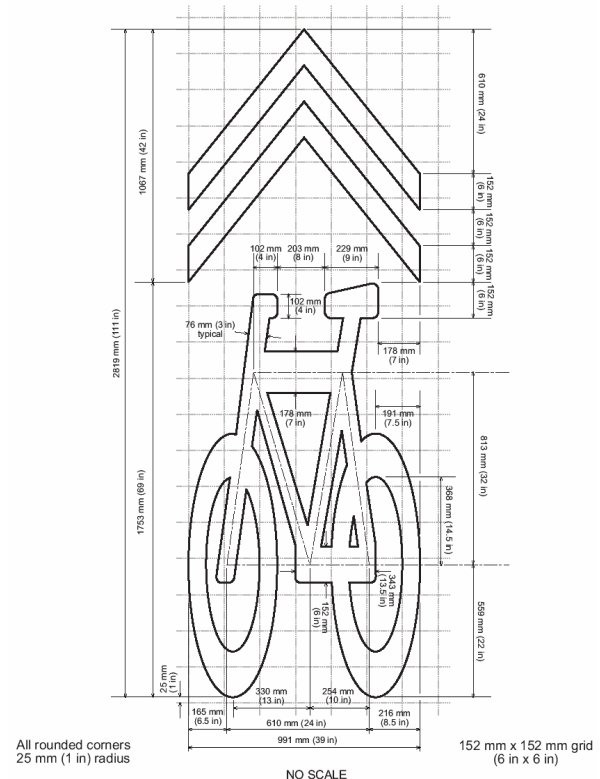
- Reduce the chance of bicyclists impacting open doors of parked vehicles on a shared roadway with on-street parallel parking.
- Alert road users within a narrow traveled way of the lateral location where bicyclists ride.
- Be used only on roadways without striped bicycle lanes or shoulders.

## Guidance

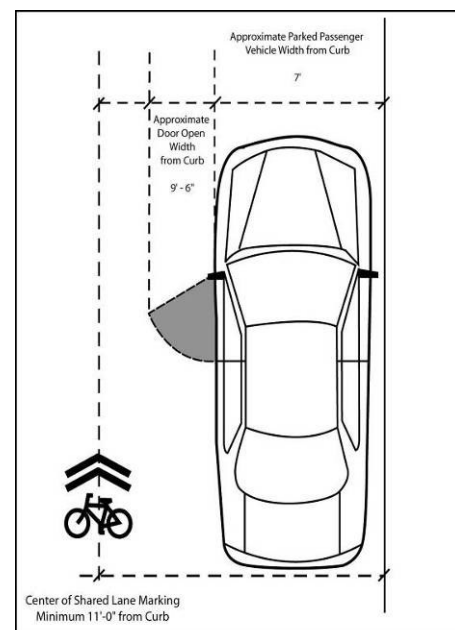
It is anticipated that sharrows will be approved in the 2009 edition of the MUTCD. The Milwaukee Bike Lane Design Guide provides a standard but it does not meet the criteria anticipated to be set in the new MUTCD

## Recommended Design

**Figure 9C-107. Shared Roadway Bicycle Marking**



## Recommended Placement





## Bicycle Boulevard

### Design Summary

Signed shared bikeways can be implemented at two levels of treatments depending on the roadway characteristics. Higher level (more intensive) treatments fall into the bicycle boulevard category. Bike Boulevards create on-street travel conditions for cyclists that do not wish to ride in bicycle lanes or may not feel comfortable on streets with heavy motor vehicle traffic.

### Discussion

- Bike Boulevards are ideal for streets with relatively low traffic volumes and posted speeds that enable cyclists and motorists to share the same travel lanes.

### Treatment Summary

- Level 1 - Signage (e.g., wayfinding and warning)
- Level 2 - Pavement Markings (e.g., Wayfinding and Warning)
- Level 3 - Intersection Treatments (e.g., turned stop signs and curb extensions)
- Level 4 - Traffic Calming (e.g., speed humps)
- Level 5 - Traffic Diversion (e.g., choker entrances)

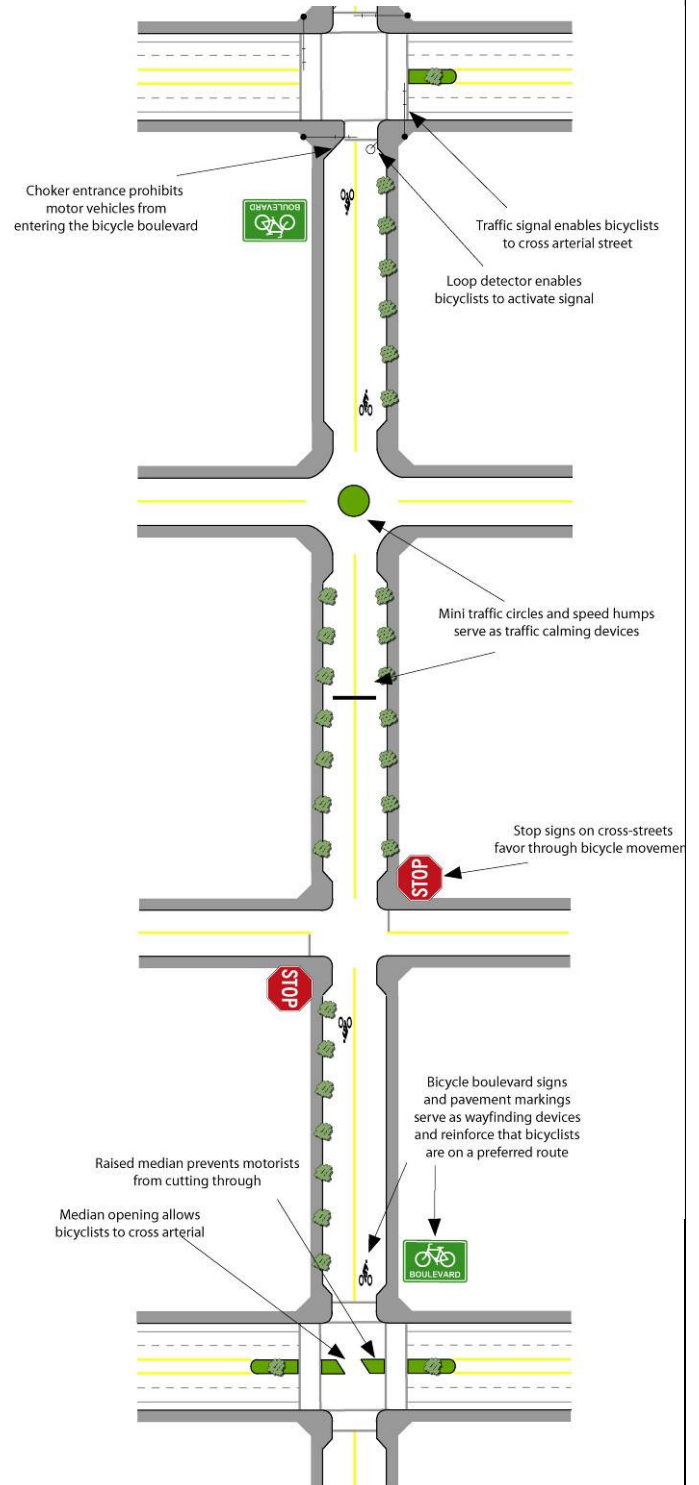
### Guidance

There is no currently adopted Federal or State guidance for this treatment though signage and traffic calming (the two key components of Bike Boulevards are discussed in the *Wisconsin Bicycle Facility Design Handbook*. This treatment will probably not require experimentation permission from FHWA. Treatments are generally site specific

### Previously Implemented in

- Portland, OR
- Vancouver, B.C.
- Berkeley, CA

### Sample Design



## Bicycle Only Left Turn Pocket

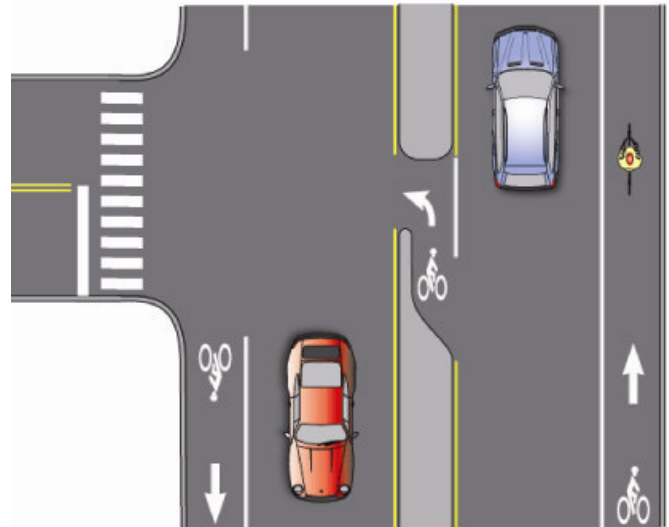
## Design Summary

**Bicycle Lane Width:**

Bicycle Lane pocket should be 4' minimum in width, with 5' preferred.

## Discussion

- A left-turn pocket allows only bicycles to access a bicycle boulevard or designated bikeway
- If the intersection is controlled the left-turn pocket may have a left arrow signal
- Signs should prohibit motorists from turning, while allowing access to bicyclists
- The left turn pocket should be protected by a raised curb, but the pocket may also be defined by striping only if necessary
- This treatment is typically applied on lower volume arterials and collectors



## Recommended Design

## Design Example



## Guidance

There is no currently adopted Federal or State guidance for this treatment.



## Bicycle Lanes at Double Right Turn Intersections

### Design Summary

#### Width:

Bicycle Lane pocket should have a minimum width of 4' with 5' preferred.

#### Discussion

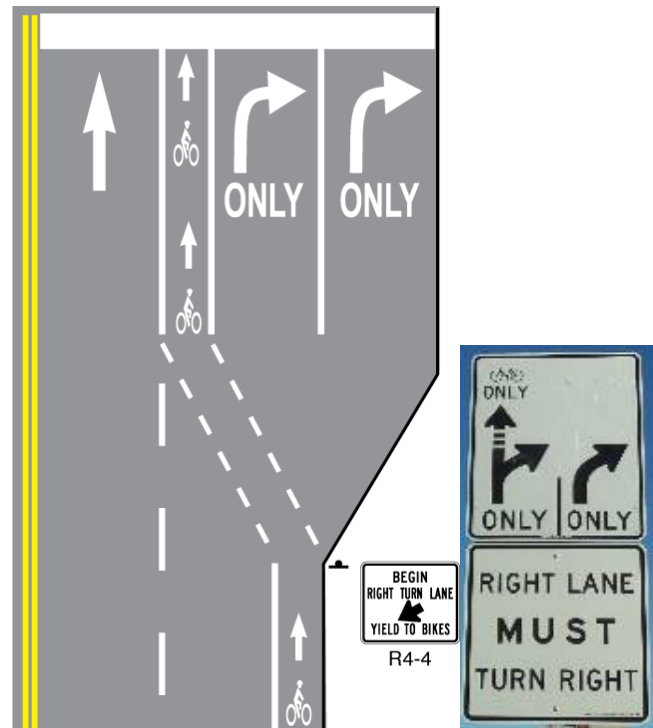
- Option A accomplishes this by providing a bike lane to the left of the outside turn lane. The design positions bicyclists to the outside of a double right-turn lane
- Option B uses shared lane markings in the through/right-turn lane properly positioning through bicyclists and reducing conflicts with right turning vehicles
- This treatment should only be considered at locations where the right most turn lane is a pocket at the intersection
- Under no circumstances should the bicyclist be expected to merge across two lanes of traffic to continue straight through an intersection
- This treatment can be done in both double right turn lane configurations and in a right/through lane as shown
- Double right turn lanes or an inside through/right combination lane should be avoided on routes with heavy bicycle use

### Design Example

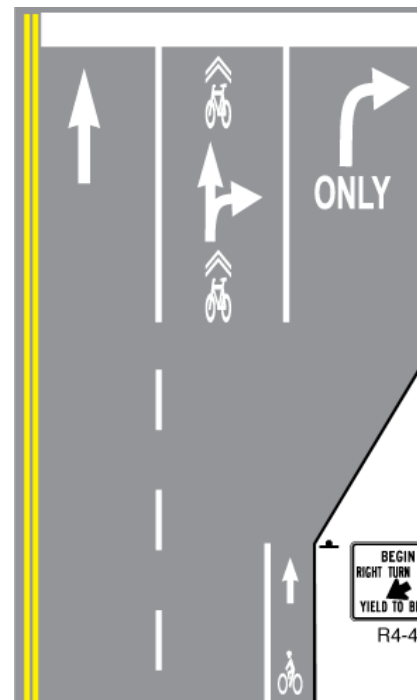


### Guidance

There is no currently adopted Federal or State guidance for this treatment.



Option A 'Bicycle Lane'



Option B 'Shared Lane Marking'

## Colored Bicycle Lanes in Conflict Areas

### Design Summary

#### Bicycle lane Width:

5' minimum and 7' maximum.

### Discussion

- Some cities in the United States are successfully using colored bicycle lanes to guide bicyclists through major vehicle/bicycle conflict points
- Colored bike lanes help the bicycle lane stand out in merging areas. The City of Portland began using green lanes in 2008, and is the color recommended for use in Milwaukee
- Colored bike lanes extend through the entire bicycle/vehicle conflict area
- This treatment typically includes signage alerting motorists of approaching conflict point
- Studies illustrate more consistent yielding behavior by motorists at these locations

### Design Example

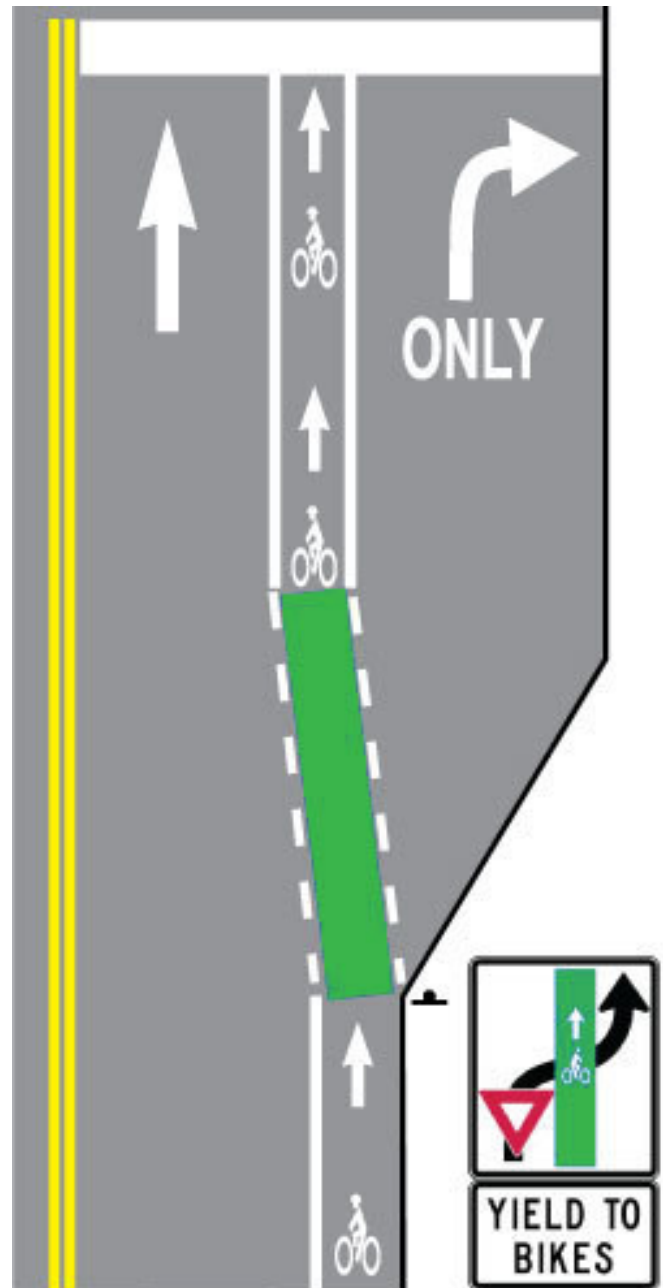


### Guidance

This treatment is not currently present in any State or Federal design standards

Portland's Blue Bicycle Lanes

<http://www.portlandonline.com/shared/cfm/image.cfm?id=58842>



### Recommended Design

## Bicycle Lanes at Interchanges

### Design Summary

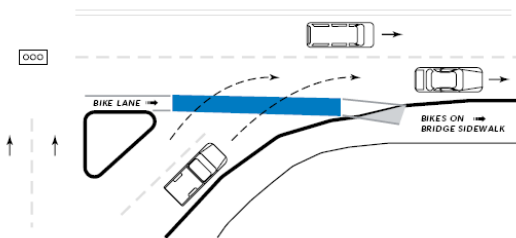
#### Bicycle Lane Width:

5' minimum and 7' maximum.

### Discussion

- Dashed bicycle lane lines with or without colored bicycle lanes may be applied to provide increased visibility for bicycles in the merging area
- The benefits of this treatment are similar to those described in the discussion of Colored Bike Lanes in Conflict Areas

### Design Example



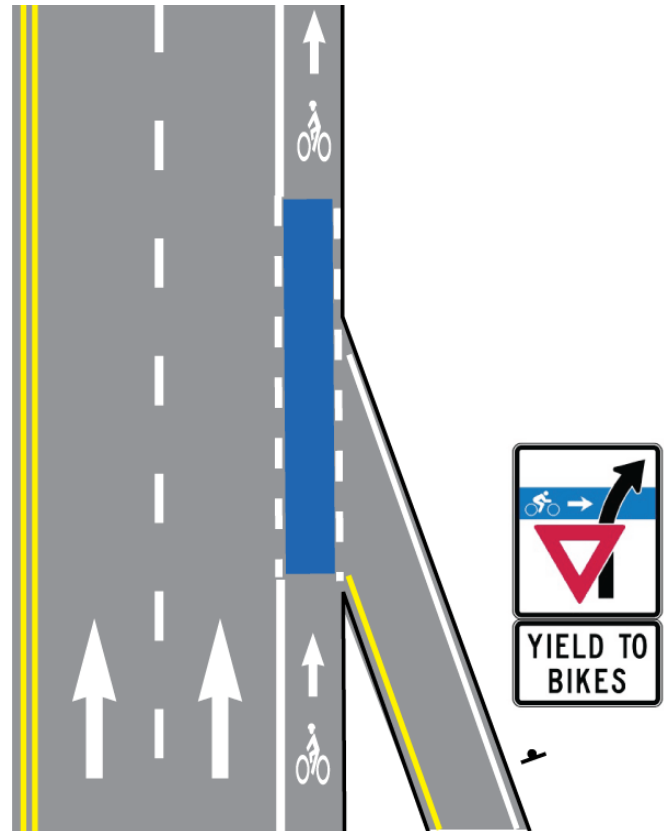
Broadway Bridge at Interstate Avenue in Portland, Oregon. Images provided by Google StreetView and Portland's Blue Bicycle Lanes

### Guidance


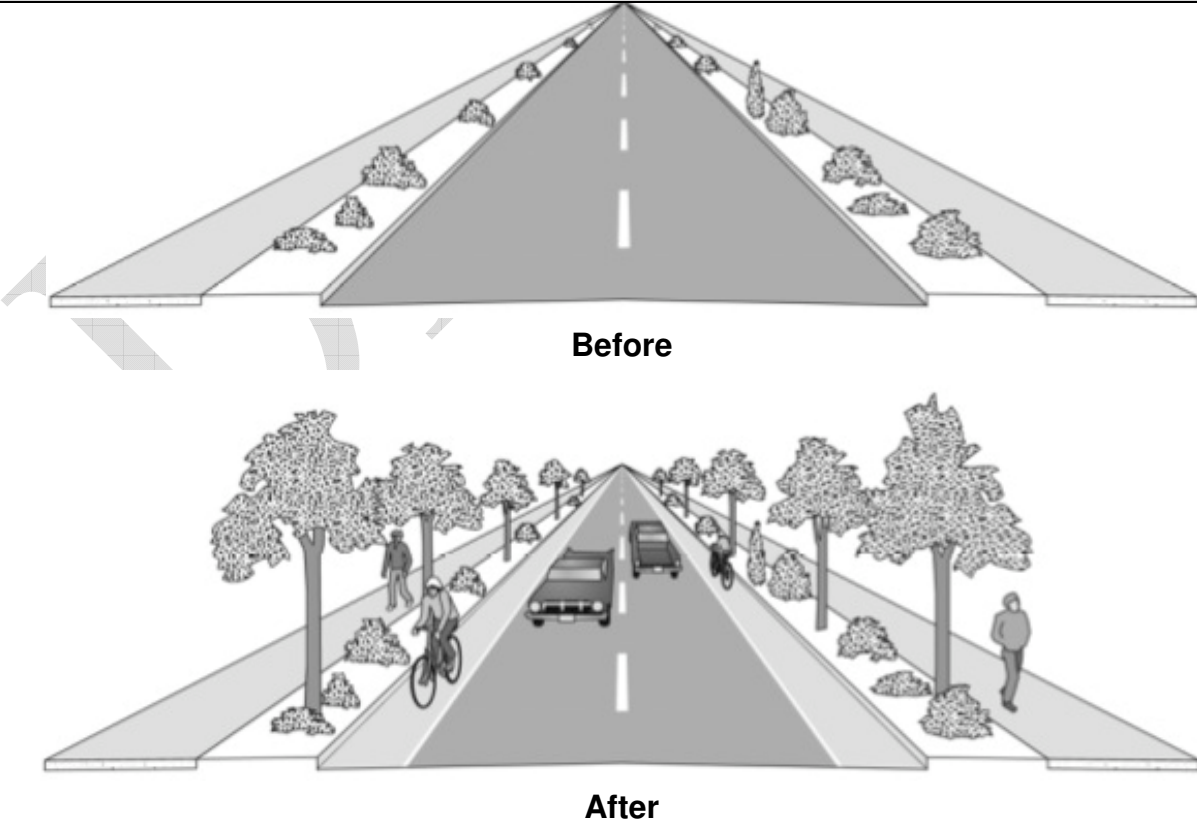
This treatment is not currently present in any State or Federal design standards

Portland's Blue Bicycle Lanes

<http://www.portlandonline.com/shared/cfm/image.cfm?id=58842>



### Recommended Design

Colored Bicycle Lanes	
Design Summary	Design Example
<p><b>Bicycle Lane Width:</b></p> <p>5' minimum and 7' maximum.</p>	
<p><b>Discussion</b></p> <ul style="list-style-type: none"> <li>A contrasting color for the paving of bicycle lanes can be applied to continuous sections of roadways</li> <li>These situations help to better define road space dedicated to bicyclists and make the roadway appear narrower to drivers resulting in beneficial speed reductions</li> </ul> <p>Colored bicycle lanes require additional cost to install and maintain. Techniques include:</p> <ul style="list-style-type: none"> <li>Paint - less durable and can be slippery when wet</li> <li>Colored pavement - colored medium in pavement during construction - most durable</li> <li>Colored and textured sheets of acrylic epoxy coating</li> </ul>	
	<p><b>Guidance</b></p> <p>This treatment is not currently present in any State or Federal design standards</p>
Recommended Design	
 <p style="text-align: center;"><b>Before</b></p> <p style="text-align: center;"><b>After</b></p>	

## Bicycle Box - Single Lane - No Vehicle Right Turns

### Design Summary

A Bicycle Box is a right angle extension to a bicycle lane at the head of a signalized intersection

#### Bicycle Box Dimensions:

The Bicycle Box should be 14' deep to allow for bicycle positioning.

#### Signage:

Appropriate signage as recommended by the MUTCD applies. Signage should be present to prevent 'right turn on red' and to indicate where the motorist must stop.

### Discussion

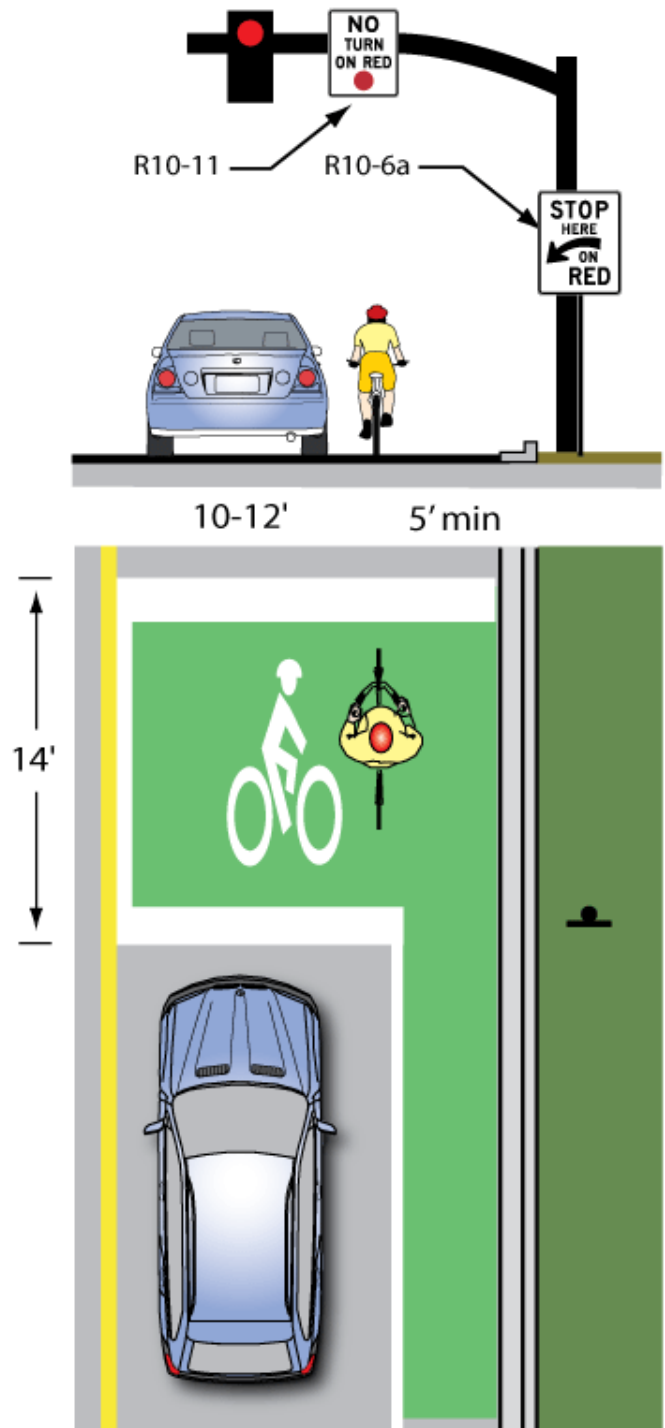
- Bicycle boxes help reduce risk of "right hook" conflicts between motorists and bicyclists
- The Bicycle Box assigns priority to bicyclists, allowing them to get in front of the traffic queue
- Signage alerting motorists to stop behind the bicycle box is advised
- On a two-lane roadway the Bicycle Box can also facilitate left turning movements for bicyclists as well as through bicycle traffic
- Motor vehicles must stop behind the white stop line at the rear of the Bicycle Box and may not turn right on red

### Design Example



### Guidance

This treatment is not currently present in any State or Federal design standards



**Recommended Design**



## Bicycle Box - Multi Lane - No Vehicle Right Turns

### Design Summary

A Bicycle Box is a right angle extension to a bicycle lane at the head of a signalized intersection

#### Bicycle Box Dimensions:

The Bicycle Box should be 14' deep to allow for bicycle positioning.

#### Signage:

Appropriate signage as recommended by the MUTCD applies. Signage should be present to prevent 'right turn on red' and to indicate where the motorist must stop.

### Discussion

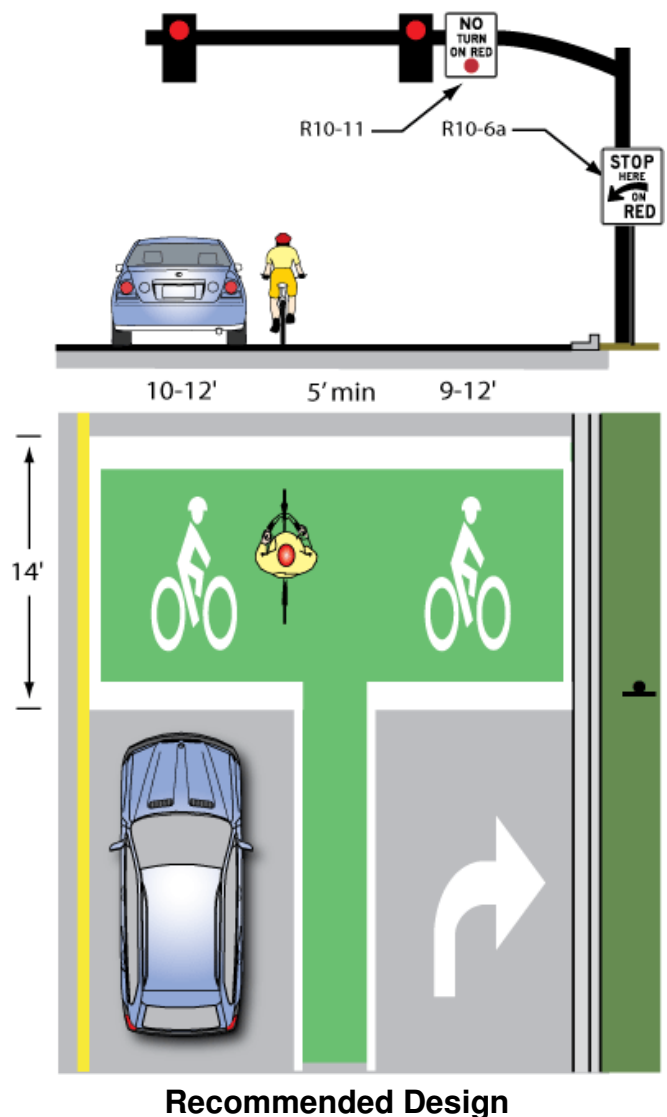
- On wider roadways the Bicycle Box can allow for movements in all directions for bicyclists enabling turning movements ahead of traffic
- This treatment can be combined with a bicycle signal or an advanced signal phase to clear queuing bicyclists before vehicles are given a green phase
- At multi-lane bicycle boxes there can be a safety issue if a bicyclist is using the bicycle box to maneuver for a left turn just as the signal turns green. This would put the cyclist possibly in the path of an approaching vehicle. It is recommended that installations wider than one lane across from the access point to the bicycle box be studied carefully before installation

### Design Example



### Guidance

This treatment is not currently present in any State or Federal design standards





## Bicycle Box - Multi Lane - Right Turns Allowed

### Design Summary

A Bicycle Box is a right angle extension to a bicycle lane at the head of a signalized intersection

#### Bicycle Box Dimensions:

The Bicycle Box should be 14' deep to allow for bicycle positioning.

#### Signage:

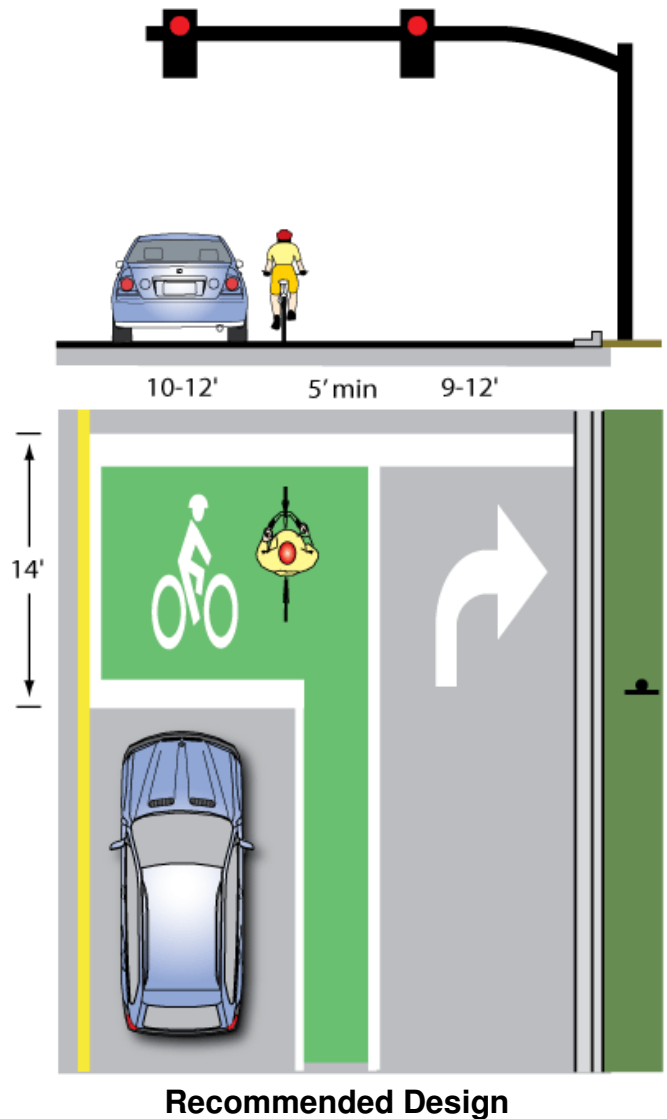
Appropriate signage as recommended by the MUTCD applies.

### Discussion

- Where bicyclists have no need or have restricted access it may not be necessary to restrict right turns on red.
- In these limited cases a vehicle right turn only lane may be provided to the outside of the bicycle box.

### Guidance

This treatment is not currently present in any State or Federal design standards



## Raised Bicycle Lanes

### Design Summary

#### Bicycle Lane Width:

5 feet minimum. Bicycle lane should drain to street. Drainage grates should be in travel lane

#### Mountable Curb Design:

Mountable curb should have a 4:1 or flatter slope and have no lip that could catch bicycle tires

#### Signage & Striping:

Same as standard bicycle lanes

### Discussion

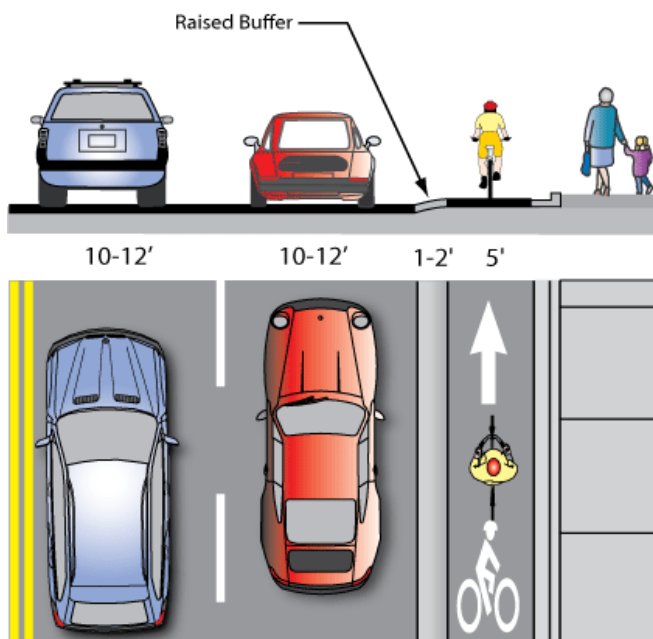
- Raised bicycle lanes have a mountable curb separating them from the adjacent travel lanes
- Provide an element of physical separation from faster moving vehicle traffic
- For drivers, the mountable curb provides a visual and tactile reminder of where the bicycle lane is
- For bicyclists the mountable curb makes it easy to leave the bicycle lane if necessary, such as when passing another bicyclist
- Raised bicycle lanes cost more than traditional bicycle lanes and typically require a separate paving operation
- Maintenance costs are lower as the bicycle lane receives no vehicle wear and resists debris accumulation
- Raised bicycle lanes work well adjacent to higher speed roadways with few driveways

### Design Example



### Guidance

This treatment is not currently present in any State or Federal design standards



### Recommended Design

## Cycle Tracks

### Design Summary

A cycle track is a hybrid type bicycle facility that combines the experience of a separated path with the on-street infrastructure of a conventional bicycle lane.

### Cycle Track Width:

7 feet minimum to allow passing and obstacle avoidance

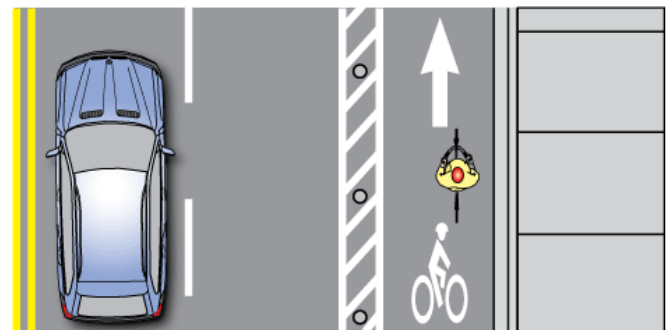
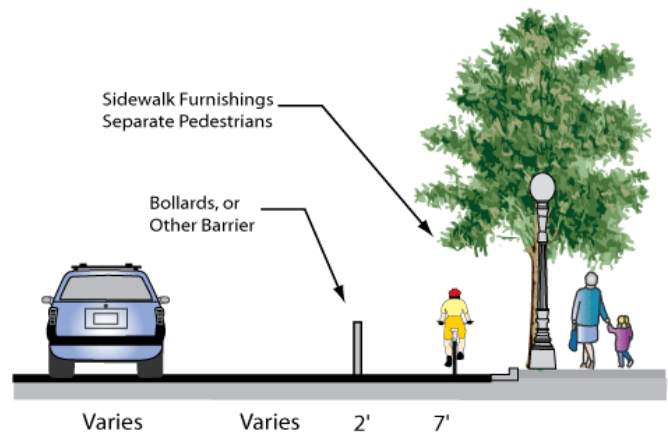
12 feet minimum for two-way facility

2 foot buffer between parking and cycle track to reduce door zone conflicts

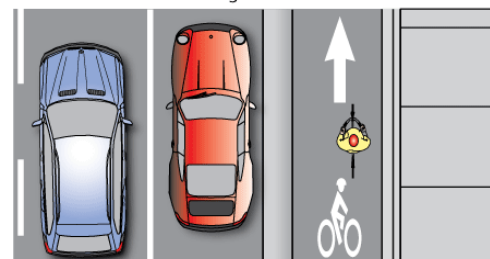
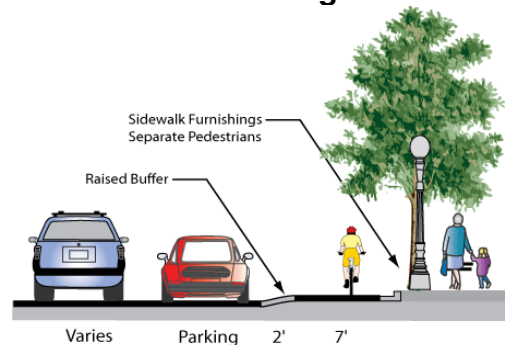
### Discussion

- Provide space that is intended to be exclusively or primarily for bicycles, and is separated from vehicle travel lanes, parking lanes and sidewalks by pavement markings or coloring, bollards, curbs/medians or a combination of these elements
- Can be either one-way or two-way, on one or both sides of a street, and are separated from vehicles and pedestrians
- Place along slower speed urban/suburban streets with few driveways or other mid-block access points for vehicles
- Careful considerations at intersections must be taken. Right turning motorists conflicting with cycle track users is the most common. For a detailed discussion, see Cycle Tracks: Lessons Learned available at <http://www.altapanning.com/cycle+tracks.aspx>.

### Design Example



**Recommended Design – No Parking**



**Recommended Design – On-Street Parking**

## Cycle Tracks - Continued

### Guidance

This treatment is not currently present in any State or Federal design standards  
Suggested guidance is available in Cycle Tracks: Lessons Learned <http://www.altaplaning.com/cycle+tracks.aspx>

